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IN THE UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF CALIFORNIA

In re DYNAMIC RANDOM ACCESS MEMORY (DRAM) ANTITRUST LITIGATION, STATE OF CALIFORNIA, et al., Plaintiffs, vs. This Document Relates to: INFINEON TECHNOLOGIES AG, et al., Defendants.	EXPERT REPLY REPORT OF DR. KENNETH FLAMM IN SUPPORT OF MOTIONS FOR THE CERTIFICATION OF GOVERNMENTAL ENTITY CLASSES

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Table of Contents

My name is Kenneth Flamm. My qualifications are described in my previous report filed with the Court in this matter.

I.   Overall Organization

This Reply Report will respond to questions and issues raised in Margaret Guerin-Calvert's Declaration in Support of Opposition to Motion for Certification of Classes and in Defendants' Opposition to the Motion for Class Certification. I will also identify a number of other conceptual errors, errors of fact, and misstatements in these two documents.

II.   Overall Observations

I have been studying the computer and semiconductor industries for approximately 25 years. I have published five books and numerous scholarly articles analyzing the economics of theses specific industries, and I have consulted for numerous firms competing in these industries. I have also served as a senior procurement official in the U.S. Department of Defense. I am familiar with principles and practices in government procurement, and I have written and published on the subjects of government computer procurement and Defense Department procurement policies.

As before, the opinions I express in this Reply Report and in my prior report are based on this knowledge and experience, as well as my general background as a trained expert in economics and econometrics. In this Report, I will review my analysis of the questions I was originally asked to examine in light of the arguments brought forth to rebut my analysis on each question, when such an argument was provided.

III.   Questions Addressed

In my original report, I examined two questions. The first question was

1. Is there a common set of facts and common method of analysis to determine if injury has been suffered by the states of California and New Mexico and their political subdivisions as the result of price-fixing by the defendants in this case?

1   My answer to this question was "yes" and remains "yes". In my previous Report, I pointed

2   out that this question could be logically divided into two sub-questions, both of which I answered

3   in my previous Report. The first sub-question is:

4   a.   Are there common facts and methods which can be used to establish

5   direct impact of a price-fixing conspiracy on DRAM prices?

6   The Court already in effect answered this questioned in the affirmative when it certified the

7   direct purchaser class. I also answered this sub-question in the affirmative, and my answer is

8   unchanged. Ms. Guerin-Calvert did not challenge this in her Declaration.

9   The second sub-question to the first question is:

10   b.   Are there common facts and methods which can be used to analyze the

11   pass-through of increased DRAM prices, resulting from a successful

12   price-fixing conspiracy, to indirect purchasers of DRAM-using

13   computer equipment?

14   I answered this sub-question in the affirmative, and my answer is unchanged. I will

15   examine her argument in detail below.

16   The second question I was asked to analyze was:

17   2.   Is there a common set of facts and a common method of analysis that can be used

18   to measure damages to the states of California and New Mexico and their political

19   subdivisions as the result of price-fixing by the defendants in this case?

20   As with the first question, my answer was and remains "yes". And, as with the first

21   question, this question can be decomposed into two sub-questions. The first sub-question is:

22   a.   Are there common facts and methods which can be used to measure the

23   direct impact of a price-fixing conspiracy on DRAM prices?

24   My answer to this sub-question remains a "yes". Ms. Guerin-Calvert has not questioned my

25   review of the data and methods required to perform this measurement, and this Court implicitly

26   answered this sub-question in the affirmative when it certified the class of direct purchasers in

27   earlier litigation, because this issue is identical to the analogous issue raised in that case.

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1   The second sub-question was:

2   b.   Are there common facts and methods which can be used to measure the

3   pass-through of DRAM prices increases resulting from a price-fixing

4   conspiracy to DRAM-using computer equipment purchases by the states

5   of California and New Mexico and their political subdivisions?

6   My answer to this sub-question was "yes" and Ms. Guerin-Calvert has argued against the

7   points I made. After considering these arguments, my answer is still "yes." I will examine and

8   refute Ms. Guerin-Calvert's arguments in detail below.

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11   IV.   The Structure of This Report

12   Insofar as the pass-through of DRAM price increases to computer equipment prices is

13   concerned, the methods and data used to determine impact are largely the same as the methods

14   and data used to measure damages. Therefore, the common data and methods of analysis

15   described in the two questions in my assignment are largely the same. In the remainder of the

16   report, therefore, in responding to Ms. Guerin-Calvert's critiques of my analysis, I will not

17   distinguish between common data and methods used to determine injury, and common data and

18   methods used to measure damages. There are, however, two specific points on which the

19   common methods and data differ across these two questions.

20   First, impact determination differs from damages estimation in that there is a unique aspect

21   to the impact question, which is addressed in my original report at pages 37 to 40. The issue is

22   how one might, if necessary, confine recovery to class members injured specifically because they

23   bought equipment containing DRAM manufactured by conspirators. In my previous Report, I

24   pointed out that, from an economic perspective, all DRAM users would be harmed by a

25   successful price-fixing conspiracy, due to the commodity nature of DRAM products produced by

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1   DRAM makers.[1] Ms. Guerin-Calvert did not challenge this conclusion. I also provided in my

2   earlier Report a method for establishing, with any desired degree of certainty, that a class

3   member had purchased one or more pieces of computer equipment containing conspirator-

4   manufactured DRAM. Ms. Guerin-Calvert has not challenged this methodology, although she

5   does for some reason state that I did not address the issue (end of paragraph 112, p. 37).

6   Second, damages estimation differs from impact determination in that there is an additional

7   methodology that might be used in estimating damages to class members that might not be

8   appropriate for demonstration of injury. This is the calibrated simulation model, discussed at

9   pages 41 to 42 of my previous Report. Ms. Guerin-Calvert has not challenged this methodology

10   in any way.

11   The balance of this Reply Report will analyze challenges to specific elements of my

12   analysis: the common data and methods that can be used both to demonstrate pass-through of

13   injury to the states and their political subdivisions as the result of the pass-through of DRAM

14   price increases caused by the alleged price-fixing conspiracy, and to measure the damages

15   suffered by these entities because of this pass-through.

16   V.   Common Data and Methods That Can Be Used to Demonstrate the Impact on, and to

17   Measure Damages to the States of California and New Mexico and their Political

18   Subdivisions

19   I begin by reiterating an important point. In my earlier Report, I examined whether

20   common data and methods were available to prove impact on and calculate damages on a

21   classwide basis; I did not actually perform this analysis. This Reply Report will be directed to

22   the same questions as before.

23   1. Established Effect of DRAM Prices on Computer Equipment Prices

24   I pointed out in my earlier Report that there is a substantial, existing body of published

25   scholarly empirical research establishing that DRAM and other semiconductor prices have a

26   _____

[1] See Tab 1 for sworn testimony by four of the defendants that there is a single price in global markets for like DRAM
27   products. A conspiracy that successfully raised price for any one group of producers' DRAM products would raise prices
     for all such products.

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1 substantial impact on computer equipment prices. My point in citing this literature was to

2 demonstrate that the evidentiary burden of proving impact would be substantially lessened

3 because there is considerable evidence of this fact already existing.

4   Ms. Guerin-Calvert responds by asserting that changes in DRAM prices over the alleged

5 price-fixing conspiracy period were "slight."[2] She presents no evidence to support her view, and

6 she does not address the extraordinary behavior of DRAM prices over the alleged conspiracy

7 period (e.g., a 100% price increase in the first quarter of 2002, the largest in the recorded history

8 of this industry) documented in my Report. In contrast, top executives at the DRAM producers

9 who are defendants in this matter have acknowledged in sworn public testimony that DRAM is a

10 commodity whose price ***normally declines*** 20 to 30 or more percent per year.[3]

11   Turning to the literature I cite, even Ms. Guerin-Calvert acknowledges "all of this support

12 for correlation between semiconductor prices and computer prices."[4] Nevertheless, she

13 erroneously attempts to minimize its importance and questions its relevance. She argues that the

14 possible effects of price-fixing, in slowing DRAM price declines below normal rates, or even in

15 increasing DRAM prices, somehow defy the empirically well-established correlation between

16 semiconductor input (e.g., DRAM) prices and computer prices, asserting that this correlation

17 "does not in any way demonstrate the impact of an alleged DRAM price-fixing conspiracy on

18 individual purchases of DRAM-using equipment by individual government entities." (p. 39, par.

19 124)

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22 [2] "no evidence" to suggest the ability to measure the extent to which *slight changes* in DRAM prices were reflected…"
Guerin-Calvert Report, p. 38, par. 118, emphasis added.

23 [3] Steve Appleton, CEO of Micron Technology, testifying before the U. S. International Trade Commission on June 23,
2003: "Well, the price decline, first of all to clarify, with respect to initially the ability to reduce its costs over time,

24 which in normal markets would correlate with price decline because you would have some margin that would be built in
over time, the industry's ability to come down the learning curve, if you will, really hasn't changed in 20 years. It's still

25 the 20 to 30 percent, and that historically has been the price decline with the exception of very, you know, artificial
market dynamics that make it move more than that." Farhad Tabrizi of Hynix, testifying on June 23, 2002: "On an

26 average, we can reduce the cost or price by about 40 percent per year." USITC Hearing of June 23, 2002, at page 255,
lines 14-16. Michael Sadler of Micron: "one can normally expect a price declined [sic] related to cost improvements on

27 the order of 20 percent per year roughly". USITC Hearing of November 22, 2002, at page 25, lines 14-16.
[4] Guerin-Calvert Report, p. 39, par. 124.

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1   Ms. Guerin-Calvert's dismissive and unfounded assertion that this body of published

2   studies has no relevance to pass-through is clearly erroneous. The articles I cited on pages 9 to13

3   of my Report specifically discuss the role of semiconductor price changes in explaining

4   computer price changes. Although none of these articles concludes that *all* of the changes over

5   time in computer prices are explained by changes in the prices of semiconductor inputs (as I note

6   in my report, DRAM and microprocessor costs equally split about 2/3 of the value of

7   semiconductor inputs), *all* these studies *do* conclude that the semiconductor prices have played a

8   very significant role in explaining computer price movements. The productivity studies that Ms.

9   Guerin-Calvert cites as irrelevant (par. 122-123, p. 39) actually do measure how much of the

10   change in computer prices is attributable to changes in the prices of semiconductors and other

11   inputs used in computers. Those studies measure productivity by first deducting the separate

12   contributions of semiconductor and other input price changes to changes in computer prices, and

13   by then ascribing the remainder to productivity improvement within the computer industry.

14   As this description suggests, this type of analysis requires that the portion of the change in

15   computer prices attributable to semiconductor price changes be estimated.   All of these studies

16   conclude that semiconductor price changes account for a very substantial share of changes in

17   computer prices (40 to 60 percent, per Aizcorbe, Flamm and Khurshid's very detailed 2007

18   study).[5] These studies clearly speak to the issue of DRAM cost pass-through.

19   None of these studies actually calculate a pass-through rate. However, reduced form pass-

20   through equations, similar to those I identified in my previous Report as usable in this case,

21   actually were estimated in at least one of the studies I cited (Van Reenan's 2004 study of

22   computer servers, which finds that "Higher input costs also have a significantly positive impact

23   on own prices").[6]

24   _____

25   [5] Guerin-Calvert States Report, p. 38, par. 120. Ms. Guerin-Calvert's Report states: "this study makes no attempt to control for other factors." The statement is incorrect. The analysis did control for the effects of the other factors, but did not make any attempt to disentangle them. That is, the study estimated the effects of all other factors (other than changes in semiconductor prices) in a single term, and made no attempt to decompose this aggregate further into component parts. The methodology did correctly account for the separate impacts of semiconductor prices and the combined effects of all other factors affecting semiconductor prices. This paper was published and has been widely cited.

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27   [6] "[O]wn price" refers to server price.

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1   Ms. Guerin-Calvert's description of this literature is inaccurate. She characterizes work by

2   Aizcorbe, Oliner, and Sichel in the following way: "The paper by Aizcorbe, Oliner, and Sichel

3   (2006) only deals with semiconductors and has no analysis of pass-through downstream."[7] In

4   fact, Aizcorbe, Oliner, and Sichel say the following in their paper: "These swings in

5   semiconductor prices have had a noticeable effect on the prices of computing equipment, which

6   use semiconductors as a key input. Figure 2 displays the price index for computers and

7   peripheral equipment in the National Income and Product Accounts along with the aggregate

8   index of semiconductor prices." (Aizcorbe, Oliner, and Sichel, p. 7). Their graph is reproduced
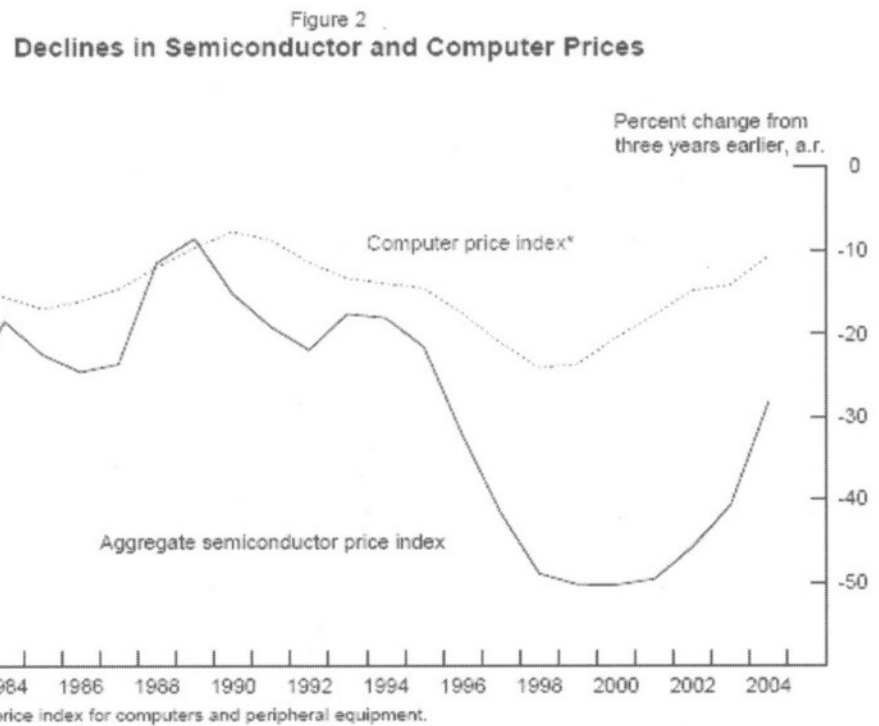
9   below.

Figure 2
Declines in Semiconductor and Computer Prices

Figure taken from Aizcorbe, Oliner, and Sichel, 2006.

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[7] Guerin-Calvert Report, p. 39, par. 123.

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1   The correlation between semiconductor prices and computer prices is evident in the above

2   graph. The correlation is not perfect because the cost of other components (e.g., disk drives) and

3   other factors shifting computer demand would also be expected to change price. However, the

4   above graph, which was created by government economists, does show the relationship between

5   semiconductor prices and computer prices at the overall level of the U.S. macro economy.

6   Similar correlations are very evident in detailed data that have been produced in this case. For

7   example, data from CDW, a vendor since 1999 to the state of California and its political

8   subdivisions through CMAS contracts, shows

9

10   CDW

11   based on Gartner data that I calculated in my Report. This suggests that a

12   full analysis taking into account other factors on both the supply and demand sides is likely to

13   conclude that pass-through from DRAM prices to computer prices is both identifiable and

14   significant.

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Lagged MA means three-quarter moving average, lagged one quarter..

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1   Indeed, we know that the reduced form pass-through equation I estimated in my Report

2   showed that DRAM prices were a statistically significant and quantitatively important

3   determinant of desktop PC and workstation prices, as measured in the U.S. producer price

4   statistics, after accounting for other supply and demand factors affecting computer prices. If the

5   same reduced-form pass-through equation is estimated using the entirely different CDW ████

6   ████   shown in the graph above, as well as the other explanatory variables used in the pass-

7   through equation displayed in Appendix C of my Report , virtually identical results are produced.

8   The coefficient for DRAM price is again highly significant statistically, and remarkably close to

9   the value estimated in my original report, indicating that significant pass-through from DRAM

10   prices to computer prices is a statistically verifiable interpretation of the behavior depicted in the

11   above figure.

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13   2.   Methods to Analyze Pass-Through

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15   The methods used by economists to measure pass-through to consumers are well

16   established, well documented, and well understood, and they are part of three voluminous bodies

17   of economic literature cited in my previous Report. The three methods are: separate estimation of

18   demand and supply relationships as part of a structural model; estimation of a reduced form

19   relation; and careful and detailed case study.

20   Ms. Guerin-Calvert challenges only one of these three methods-- the reduced form

21   method.[8] She mounts this challenge by quoting a passage from the **ABA Section of Antitrust**

22   **Law, Econometrics (2005).** However, the quotation she presents is very much out of context.

23   The entire passage actually supports my contention that the reduced form method can

24   appropriately be used to make the type of assessment I have proposed. I reproduce below the

25   quotation Ms. Guerin-Calvert gave. I have added, in italics, the text that immediately follows the

26   material that Ms. Guerin-Calvert quoted:

27   ───────────────
     [8] Guerin-Calvert Report, par. 133, pp. 41-42.

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1   The reduced-form pricing equation assumes that a conspiracy has the same effect

2   on every purchaser and focuses on an average effect, which may hide variation across

3   class members. If one is attempting to test whether there is impact on all class members

4   of a proposed class, however, that assumption is not valid, as it assumes the very

5   proposition that is being tested. *As a result, somewhat more complex models that do not*

6   *make such an assumption must be used to test for class-wide impact.*

7   *One approach is to divide the proposed class into categories and use a model*

8   *that allows the value of the dummy variable to be different for different categories.*

9   *This would be appropriate if members of the proposed class can be grouped using some*

10   *observable structural characteristic that is believed to affect the price they will pay. For*

11   *example, customers in one area may have seen smaller price increases than customers*

12   *elsewhere because there was a small firm in the area that did not participate in the*

13   *conspiracy.*

14   *Assuming that one can support this type of structure, the first reduced-form*

15   *regression model could be changed to include a dummy variable that has a value of*

16   *one during the time period of the conspiracy only if a customer is in the area that is*

17   *believed to have had a smaller price effect. The model would produce one estimate of*

18   *the effects of the conspiracy for customers not in the affected area and another for*

19   *customers in the affected area. The hypothesis that customers in the affected area had*

20   *a smaller price increase can be tested by the value of the dummy variable for customers*

21   *in the affected area. If that coefficient is negative and significantly different from zero,*

22   *then the results will support the view that those customers suffered a smaller price*

23   *increase.*[9]

24   Thus, the ABA book from which Ms. Guerin-Calvert quoted does not say that a reduced-

25   form pricing equation is inadequate or invalid in testing for impact. It instead says that, if there

26   is reason to believe that there are systematic differences in impact experienced by class members

27   _____

[9] ABA Section of Antitrust Law, *Econometrics* (2005), p. 222-223.

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1   as the result of a conspiracy's effect on prices, then the reduced form pricing equation should be

2   specified in a manner that allows for such systematic variation in impact to be tested. Thus, this

3   source actually validates the use of a properly specified reduced-form pricing equation.

4   At various points in my initial Report, I propose precisely the sort of more precise reduced-

5   form pricing equation that the ABA book advocates. I noted that it can be appropriate to control

6   for contract volume in analyzing price data, because volume discounts are a well understood

7   economic phenomenon.[10] I also noted that rich data sets exist that would permit investigation of

8   differences in price across purchasing mechanisms if appropriate, though I would not expect *a*

9   *priori* to detect significant differences.[11]

10   In addition, Ms. Guerin-Calvert repeatedly says that both demand and supply factors affect

11   pass-through, and she implies that this would make an analysis difficult or impossible. In reality,

12   all three of the methods discussed in my report control for both supply-side and demand-side

13   factors in estimating pass-through of production cost increases to output prices. These same

14   three economic methods are routinely used to estimate the effects of pass-through, in the

15   numerous published economic studies in the three bodies of literature I cite in my original report,

16   while taking into account changes in both supply-side and demand-side factors.

17   VI.   Greater Than 100% Pass-through

18   Ms. Guerin-Calvert maintains that pass-through of the cost of DRAM into the prices of

19   equipment containing DRAM cannot exceed 100%. (This phenomenon is called "overshifting.")

20   On this point, she is both inconsistent and incorrect.

21   Ms. Guerin-Calvert's positions on this topic are presented at Tab 2. In short, they are:

22   • In her Report to this Court in the fall of 2007, Ms. Guerin-Calvert took the

23   unconditional position that standard economic theory held that pass-through could

24   not exceed a maximum of 100%. Guerin-Calvert Report (Private Indirect

25   _____

26   [10] See, for example, Flamm report, p. 27, line 18; p. 49, line 9. On the economics of purchasing discounts, Besanko, Dranove, Shanley, and Schaefer describe three situations in which bulk discounts might be offered, then conclude that "if these conditions do not hold, then purchasing economies may be nonexistent." D. Besanko, D. Dranove, M. Shanley, and S. Schaefer, *The Economics of Strategy*, 4th Edition, (Wiley: Hoboken, NJ), 2007, p. 86.

27   [11] Flamm Report, p. 50.

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Purchaser Case) pp. 21-22, par. 57-8. She criticized experts for private plaintiffs for their "bizarre result" that pass-through rates might exceed 100%.[12]

In deposition in the fall of 2007, Ms. Guerin-Calvert further elaborated on this point, stating that

Guerin-Calvert Deposition (Private Indirect Purchaser Case) p. 221, lines 3-6. In her current Report, filed in February 2008, Ms. Guerin-Calvert now reverses her position, conceding that the literature review had identified "some theoretical conditions required for "overshifting." **"One such necessary (but not sufficient) condition is that the downstream firms have market power."** (Guerin-Calvert Report p. 40, par. 127)

- In deposition in March 2008, Ms. Guerin-Calvert

(p. Guerin-Calvert Deposition p. 119, lines 10-20)

In fact, it is undisputed, in the economic literature and in widely-accepted economic theory, that overshifting is possible in numerous circumstances. In particular, it is undisputed that overshifting is possible in markets with many suppliers of differentiated products and easy entry and exit, a situation known as "monopolistic competition." Despite Ms. Guerin-Calvert's statements to the contrary, there is no general result in economic theory that pass-through cannot

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[12] "…a bizarre result that invalidates his [Harris'] entire methodology." Guerin-Calvert Report (Private Indirect Purchaser Case), p. 21, par. 57.
"The Bohn Declaration follows the Harris Declaration in asserting that pass-through rates can—and according to Prof. Bohn would be expected to—exceed 100%. As demonstrated above, that assertion is inconsistent with standard economic theory." Guerin-Calvert, Indirect Purchaser Report, p. 30, par. 75.

1   exceed 100 percent in markets with the characteristics of "monopolistic competition," as defined

2   above.[13]

3   Indeed, pass-through in excess of 100% would actually be expected in industries where

4   firms produce differentiated products in competitive conditions, and face economies of scale—

5   that is, where their average cost of producing a product declines with their level of output. In

6   particular, as I note in Tab 3, in competitive industries with differentiated products and relatively

7   easy entry and exit (monopolistic competition), when there are economies of scale, overshifting

8   will be the *rule*, not the exception. Empirical studies by economists have characterized the

9   personal computer industry as an industry which fits this description.

10   For this reason, it is likely that pass-through is greater than 100%, in the market conditions

11   that prevail for most, if not all, of the types of computer equipment considered in the Plaintiffs'

12   complaint. These points are discussed in detail in Tab 3.

13   Finally, as I pointed out in my original Report, to the extent that distributors, wholesalers,

14   and retailers selling to government entities or to others in the distribution chain price their sales

15   as their cost plus a fixed markup, this will create an additional reason for pass-through to exceed

16   100 percent. We know that the State Computer Store contracts for computer equipment were

17   structured as cost-plus-markup. We know through declaration that CDW's ▮▮▮▮▮▮▮

18   ▮▮▮▮▮▮▮▮, and it is a matter of public record that CDW sold computer

19   equipment through CMAS contracts to California government entities over this period.

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22   [13] ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮

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27   ▮▮▮▮▮▮▮
     Guerin-Calvert Deposition, March 7, 2008, p. 118, lines 10-20

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